

# AGRICULTURE

## Project Fact Sheet



## DEVELOPMENT OF ENERGY-SAVING GRAIN-DRYING INVENTION

### BENEFITS

- Could save 3.6 billion Btu of natural gas per installation annually
- Could save 9.2 trillion Btu annually by 2010
- Provides superior moisture control by removing only the moisture necessary to ensure safe, long-term storage of the grains
- Offers uniform drying conditions for the entire quantity of grains
- Results in superior grain quality because of minimal degradation during the drying process
- Is more than twice as energy efficient as conventional technology
- Offers competitive life-cycle cost

### APPLICATIONS

The grain-drying innovation represents a new class of technologically advanced grain dryers. Primary U.S. market opportunities include farms with large corn or rice acreage and commercial elevators and agricultural cooperatives that dry grain. Additional commercial applications are possible in all grain-drying areas of the world.

### A NEW APPROACH TO GRAIN DRYING OFFERS MULTIPLE DRYING, HEAT RECOVERY, AND HEAT-CONSERVATION TECHNOLOGIES

Most of the U.S. corn and rice crops harvested each year must be dried with heated air to prevent spoilage. The drying processes now in use require more energy than is theoretically necessary to ensure long-term storage of the grain.

The two common dryer configurations on farms and at commercial elevators are the crossflow and the in-bin counterflow processes. The crossflow configuration forces heated air horizontally through the vertical column of grain, causing significant temperature and moisture gradients across the grain. While grain at the air inlet is overdried and excessively heated, grain at the air-discharge side retains an elevated moisture level and a lower temperature. In addition, the high-temperature drying, followed by rapid cooling, is known to cause stress-cracking of the kernels, leading to kernel breakage and a marked loss in quality.

An energy-saving grain-drying invention has the potential to reduce energy use by more than 60%. This innovative new technology recaptures latent heat and uses additional heat-conservation technologies. The new grain dryer uses parallel-flow drying sections separated by tempering zones. These drying sections and tempering zones ensure that the drying stages proceed at the most rapid and economical rate to retain energy efficiencies and grain quality.

### GRAIN-DRYING SYSTEM ATTACHED TO SILOS



The new grain-drying technology, developed by Shivvers, Inc., provides superior moisture control and uniform drying conditions while saving energy.



## Project Description

**Goal:** Use computer models of the integrated drying technologies to develop a control system and mechanical design, which will subsequently guide the production of prototypes for testing and demonstration.

The innovation saves energy in four ways: first, by optimally using the heated air; second, by adjusting the moisture within the grain through tempering for efficient, high moisture-removal rates in the drying sections; third, by recovering and reusing heat from the exhaust air; and fourth, by using insulation in appropriate areas.

The advantages of the new dryer over crossflow systems include superior energy efficiencies, improved moisture control capabilities, and superior grain quality. Compared with in-bin counterflow systems, the new technology offers increased energy efficiencies and higher capacity. The new dryer will also offer a competitive initial cost compared with both types of conventional dryers.

Shivvers Incorporated is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in U.S. Department of Energy's Office of Industrial Technologies.

## Progress and Milestones

- Design a full-scale mechanical prototype based on the selected design and create engineering drawings.
- Create the computerized codes necessary for system control.
- Assemble, test, and analyze a prototype grain dryer.
- Based on the test results, incorporate improvements into the prototype design.

## Economics and Commercial Potential

The primary market for the grain-drying innovation comprises an estimated 5,000 commercial elevators as well as over 86,000 corn farms and 6,000 rice farms with more than 250 acres in production. In addition, many of the commercial elevators and larger farms have multiple grain-drying systems. Taking into account that American farmers have historically embraced products that can enhance their competitiveness, the total available market could surpass 100,000 installed units, valued at approximately \$100 million per year. The sale of foreign licenses could substantially increase these figures.

Energy savings from using the new technology are expected to be significant. The common dryer configurations in use today consume over one-third of the total energy required for corn production. In particular, the dryers used today average 2,560 Btu per pound of water removed compared with about 1,000 Btu for the new technology.

This technology could save 3.6 billion Btu of natural gas per installed unit each year. First sales for the technology are expected by 2006. Based on 15% market penetration by 2010, annual savings could be 5.5 trillion Btu with 1525 units installed. Market penetration of 60% by 2020 could save 66 trillion Btu annually from the operation of 18,275 units.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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## INDUSTRY OF THE FUTURE—AGRICULTURE

*Agriculture, a target industry for the Industry of the Future initiative, emphasizes partnerships to develop technologies for using plants, crops, and their wastes as starting materials for industrial products. An agriculture industry team has been formed within OIT to facilitate agriculture industry/federal government partnerships. This team will leverage resources available to established OIT teams, such as the chemicals and forest products teams, to strengthen the contributions of the agriculture team and to bring new ideas to the service of the agriculture industry.*

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